**Functional components of Cranial nerves**

**Review of Spinal Nerves**

The PNS is divided anatomically into two sets of nerves:

1. The cranial nerves (12 pairs): These are attached to the brain and use named foramen in the skull to go to and from their targets.

2. The spinal nerves (31 pairs): These are attached the spinal cord and use the intervertebral foramen to go to from their targets.

Functionally the PNS is made up of

1. Somatic components: this includes somatic afferents and somatic efferents.

2. Visceral or autonomic components: this includes visceral efferents (which innervate smooth muscle, cardiac muscle and glands) and visceral afferents.

The components of a typical spinal nerve are diagramed below.



Neuronal cell bodies of the **SOMATIC AFFERENTS** (sensory neurons receiving information from the skin of the body and limbs) are located in the Dorsal Root Ganglia. The neuronal cell bodies of the **SOMATIC EFFERENTS** (motor neurons that supply the skeletal muscle of the trunk and limbs) are located in the ventral horn of the spinal cord. The ventral root and the dorsal root meet to form the spinal nerve. The spinal nerve is a **mixed** nerve that means that it contains both somatic efferent (motor) and somatic afferent (sensory) fibers.

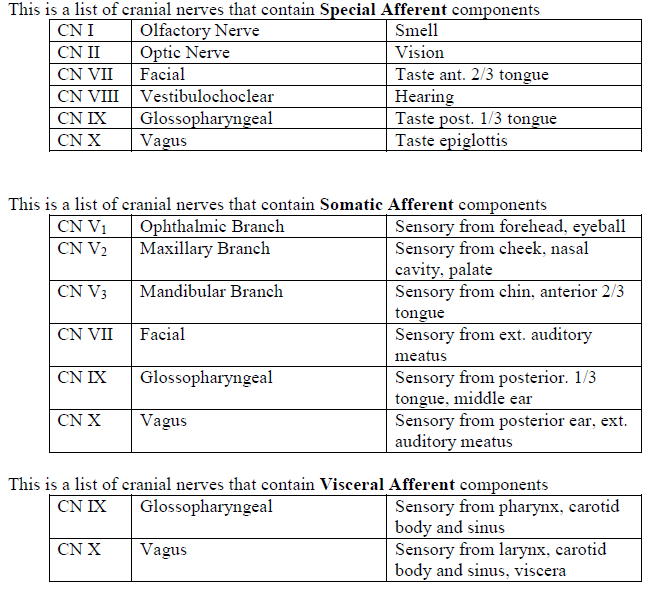
When it comes to the cranial nerves, not all are mixed nerves in fact most are **not** mixed. That means that they may be somatic afferent only or somatic efferent only or both.

**Functional Components of Cranial Nerves**

As just stated, not all cranial nerves are mixed nerves, therefore you can not draw a picture of a **typical** cranial nerve. Each cranial nerve serves a different function in the head so the diagram of each cranial nerve looks different. However, you can classify cranial nerves into groups based on their functional components.

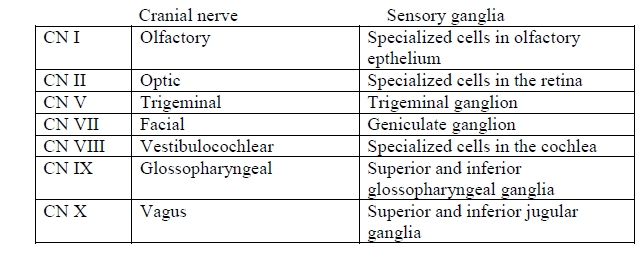
**Cranial Nerves with Sensory Components**

Cranial nerves may contain three different types of sensory components. Some cranial nerves carry information about general sensation (that means information about pain, touch and temperature). These cranial nerves are said to have **Somatic Afferent** components. Other cranial nerves carry information from the special senses (smell, vision, hearing and taste). These cranial nerves have **Special Afferent** components. Other cranial nerves carry sensory information from the viscera called **Visceral Afferents**.





Sensory cell bodies associated with the spinal nerves are located in the dorsal root ganglion (DRG). For cranial nerves the afferent cell bodies are located in the named ganglia (listed below) or they are themselves specialized in some way.

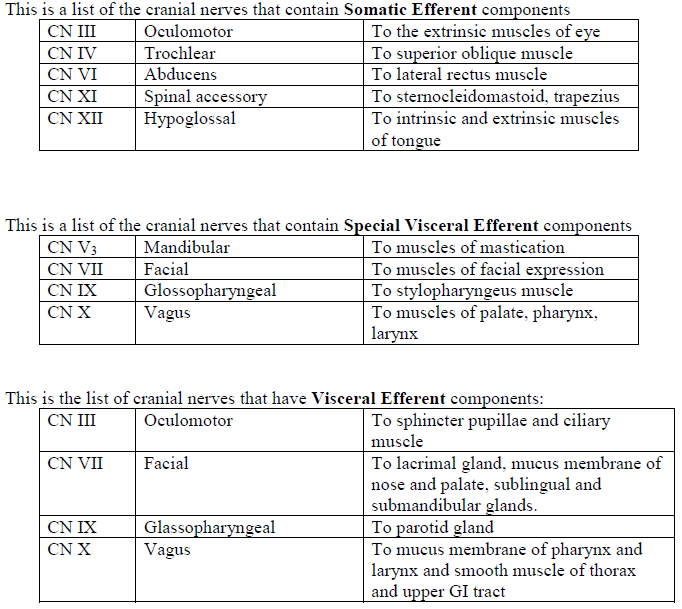


You may have noticed that three of these cranial nerves contain more than one type of sensory component. (Facial, Glossopharyngeal and Vagus). Many times the afferent cell bodies of these different components are housed in the same ganglia.

**Cranial Nerves with Motor Components**

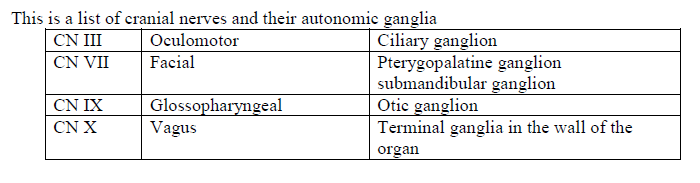
Cranial nerves may contain two\* different types of efferent fibers. **Somatic Efferent** fibers carry neural impulses to skeletal muscles of the head and neck. **Visceral Efferent** fibers carry impulses to smooth muscles and glands of the head and neck.

\*There is a special classification for efferent fibers associated with cranial nerves that supply skeletal muscle derived from pharyngeal arches. This classification is confusing at best because these fibers are called **Special Visceral Efferents** (SVE). SVE components supply skeletal muscle so they are similar in organization to other somatic efferents of the head.



Remember the visceral efferent is a two cell chain. The preganglionic neuron resides in the CNS and the postganglionic neuron is located in an autonomic ganglia.

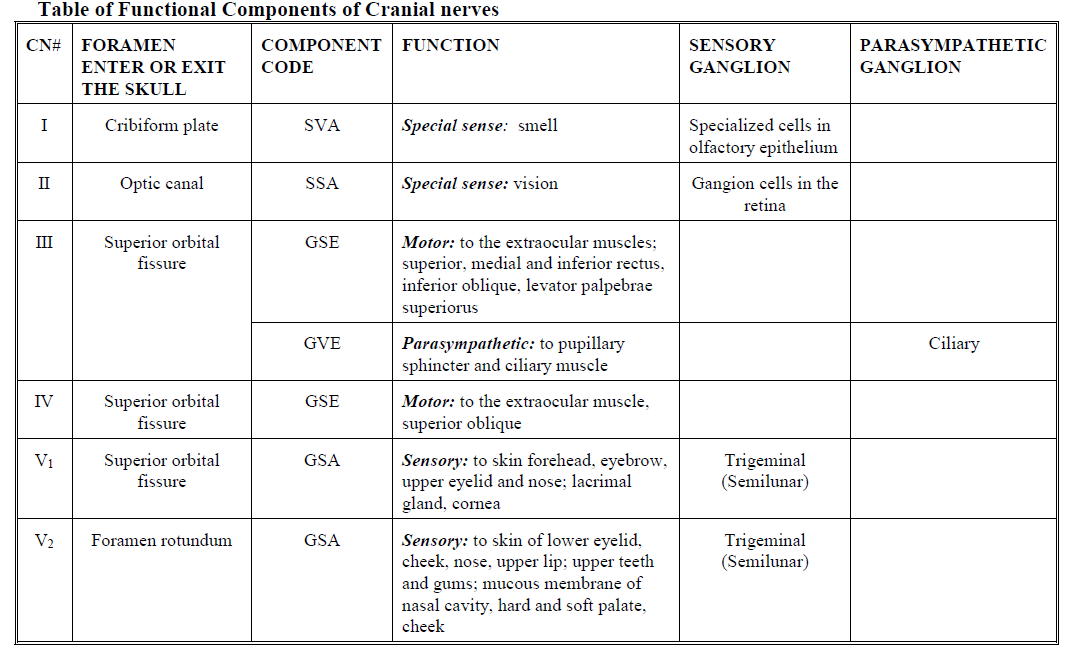


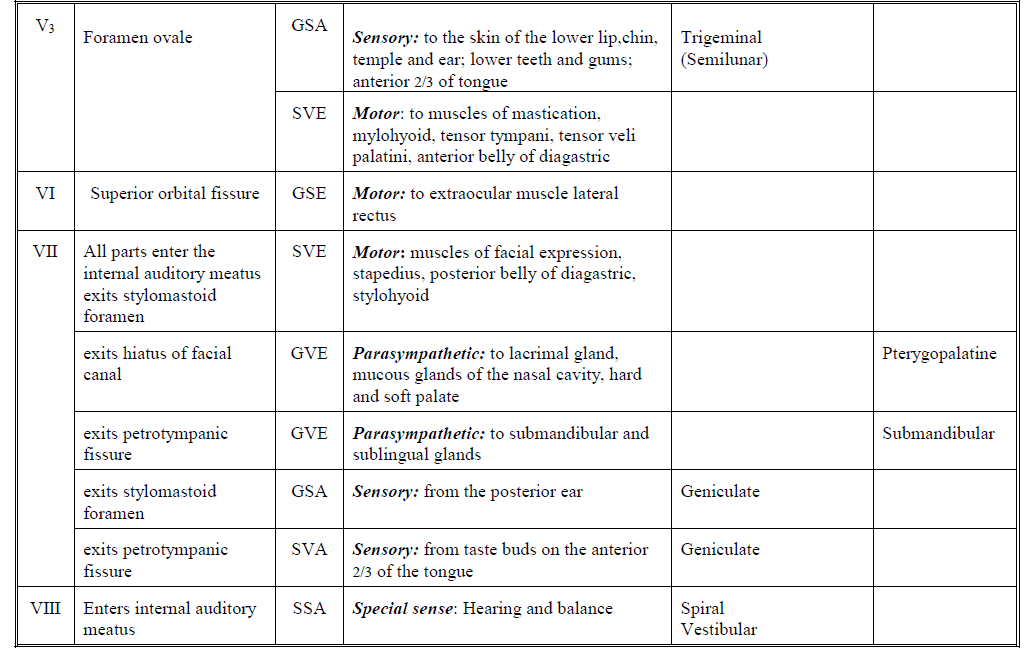


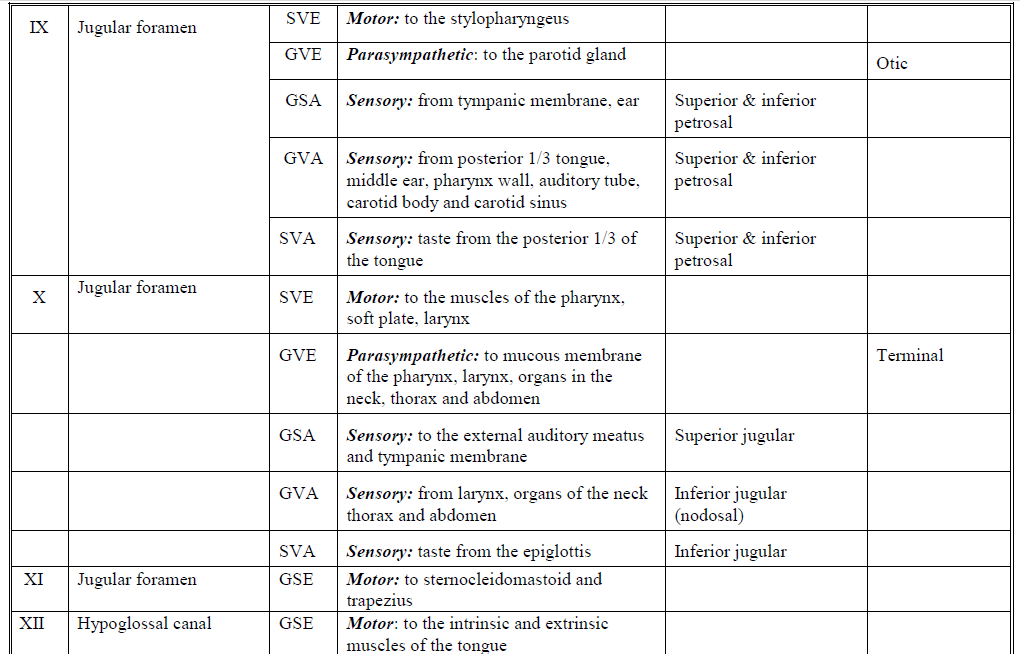
All of the visceral efferent components listed above are part of the parasympathetic division of the Autonomic Nervous System.

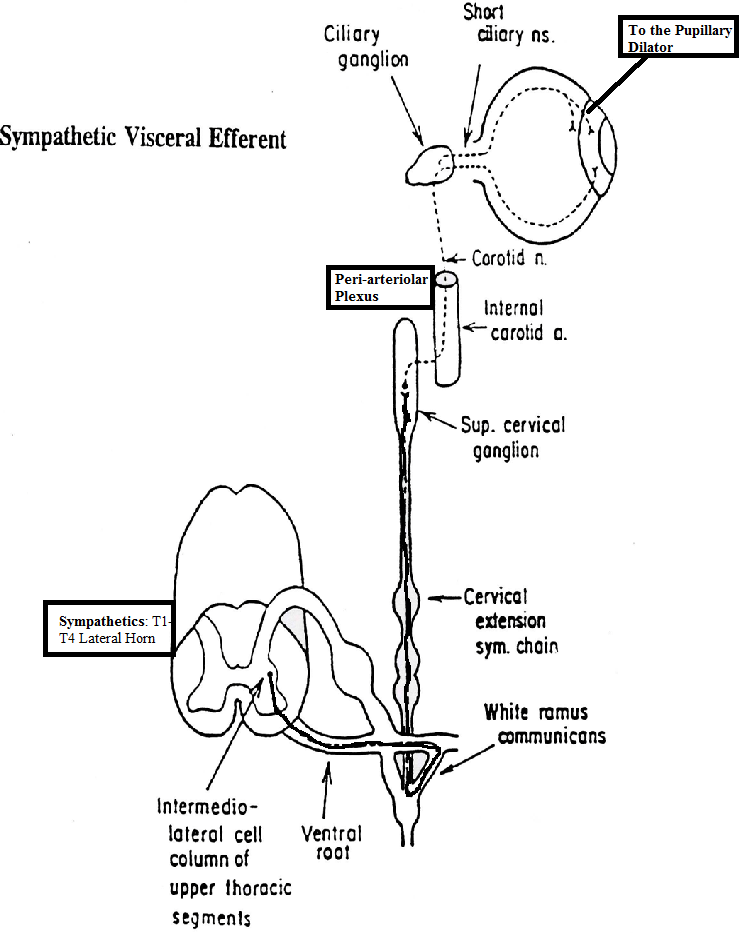
Three of these parasympathetic ganglia are associated with the branches of the trigeminal nerve. The preganglionic fibers do not arise from the trigeminal nerve therefore they are not considered components of these nerves, however, the postganglionic fibers are distributed with the branches of the maxillary and mandibular divisions of the trigeminal. We will discuss the course of these fibers in class.

As you can tell many of the cranial nerves contain several different components. Attached is a complete list of all of the cranial nerves and of their components.









\*\*\*It is important to understand that the cranial nerves and sympathetic fibers may be considered to have fibers that join/hitch-hike on other nerve fibers

Example: Chorda Tympani joins/hitch-hikes on lingual nerve from CN V3

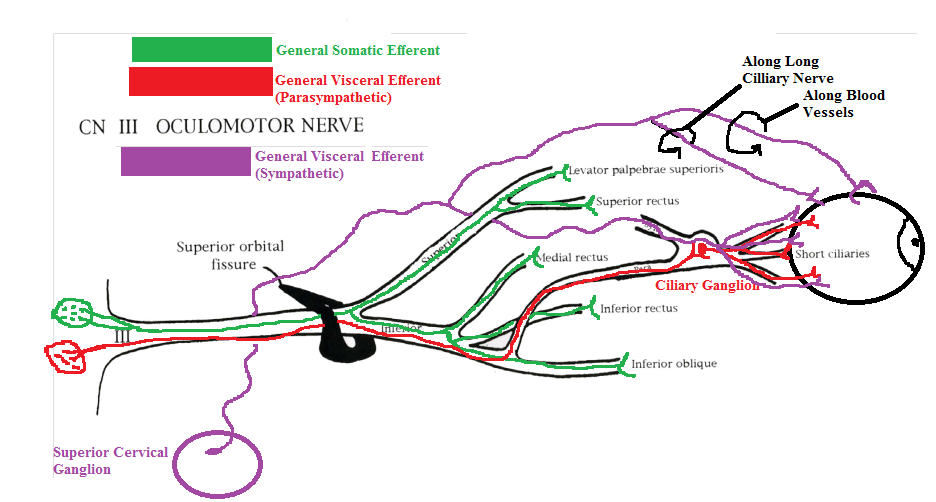
Example: Sympathetic fibers from the pterygoid fossa joining/hitch-hiking on other nerves to travel to their targets

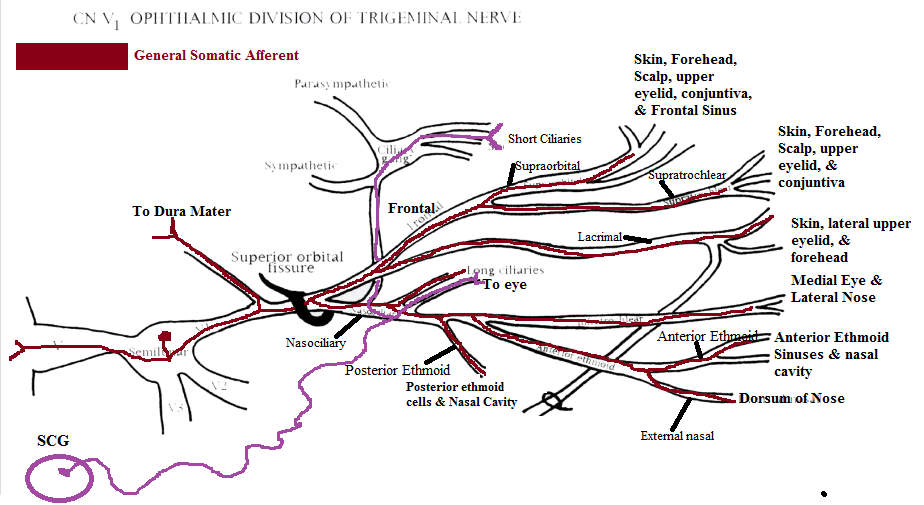
\*\*\* The sympathetic nerve fibers will take multiple roots to their targets

Example: Sympathetics to Pupillary Dilator muscle goes along 2 paths:

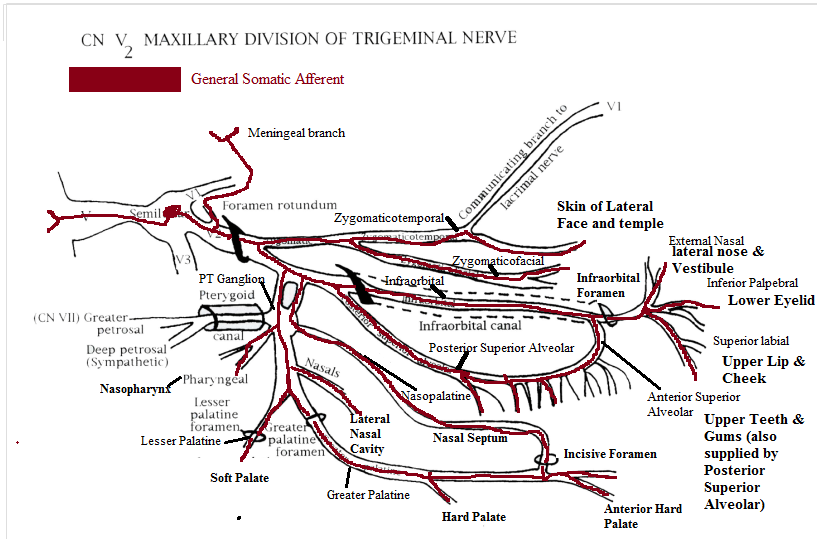
1. Peri-arteriolar Plexus to short cilliary nerves

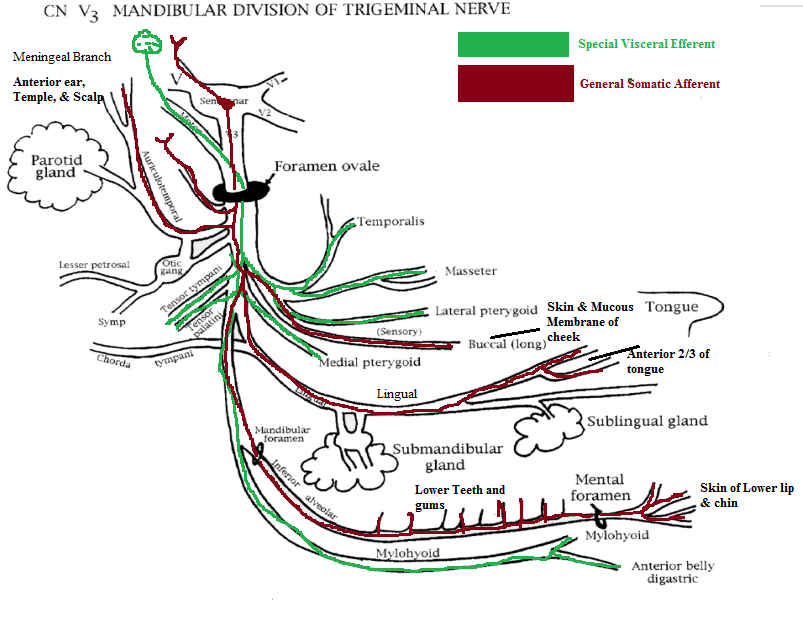
2.Long ciliary nerve



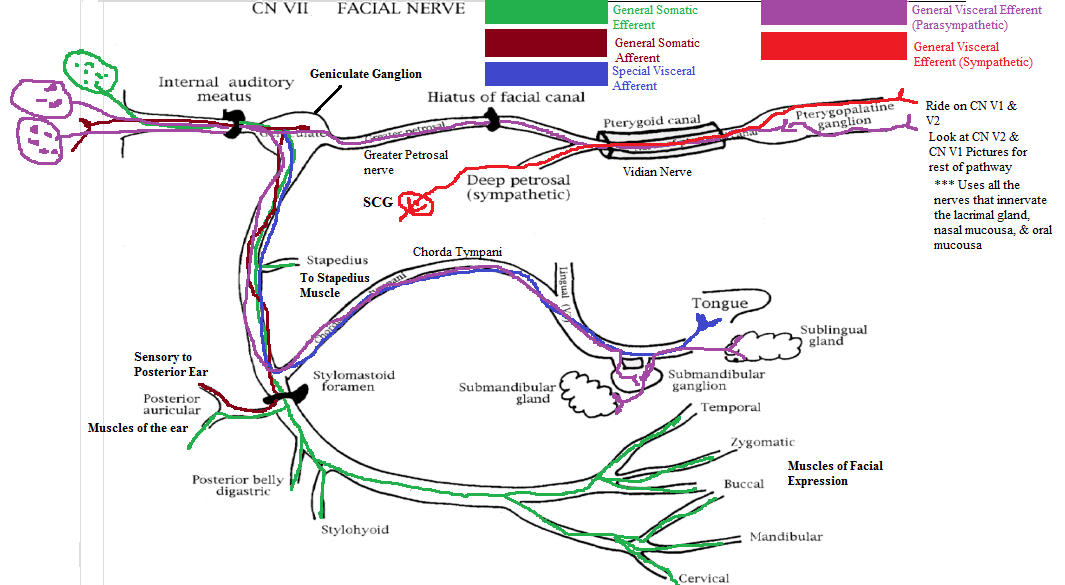


\*\*\*Trigeminal ganglion also called the Semilunar Ganglion



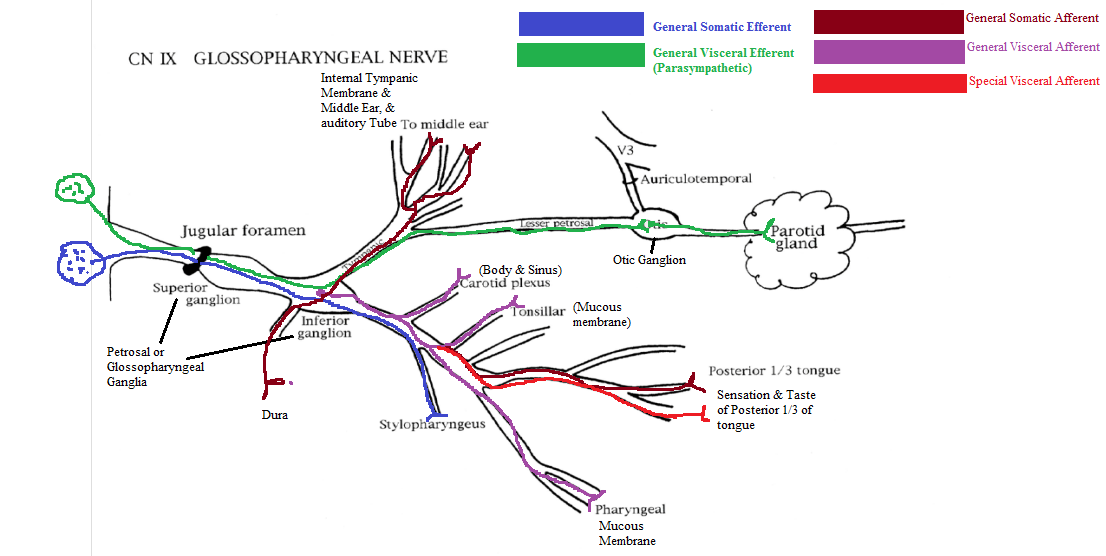


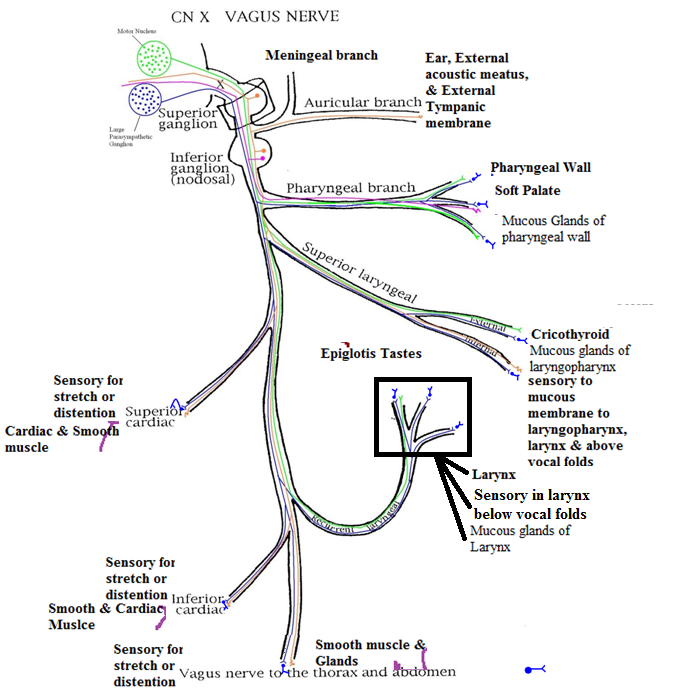
\*\*\*Motor part exits stylomastoid Foramen



\*\*\*You can loose sensory cells in geniculate ganglion = loss of posterior ear sensation & taste

\*\*\*A lession of the facial nerve at site of geniculate ganglion = loss of everything (Facial expression, taste, ear sensation, parasympathetics)





|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Cranial Nerve** | **Name for Preganglionic Fibers** | | **Name of Ganglion** | **Name for Postganglionic Fibers** | | **Effectors** | |
| III | Occulomotor nerve | | Ciliary | Short Ciliary Nerves | | Pupillary Sphincter & Ciliary Muscle | |
| VII | Greater Petrosal Nerve | | Pterygopalatine | -Along the branches of CN V1 & 2 (lacrimal)  -Along branches of CN V2 (Mucous glands) | | Lacrimal Gland & Mucous glands of nasal cavity and palate | |
| VII | Chorda tympani & Lingual Nerve from CN V3 | | Submandibular | -Directly (Submandibular gland)  -Rejoin lingual nerve (Sublingual gland) | | Submandibular & sublingual gland | |
| IX | Lesser Petrosal Nerve | | otic | Auriculotemporal nerve | | Parotid gland | |
| x | Vagus & its Branches | | Terminal ganglia | In or near effector | | Mucous glands of pharynx & Larynx  Smooth muscle cardiac muscle & other glands | |
| **Cranial Nerve** | | **Sensory Ganglion** | | | **Parasympathetic Ganglion** | |
| Occulomotor | | **None** | | | Ciliary | |
| Trigeminal | | Trigeminal or Semilunar | | | **None** | |
| Facial | | Geniculate | | | Pterygopalatine & Submandibular | |
| Glossopharyngeal nerve | | Superior & Inferior Petrosal/glossopharyngeal | | | Otic | |
| Vagus | | Jugular (Superior) & Nodose (inferior) | | | Terminal ganglia | |